

HUMAN INFLUENCES

The term “human influences” is the central theme for the second part of this GPRA goal. The term has purposefully been selected in order to explore the full breath of possibilities, both inside the park and external to the park boundaries. Adjacent land use, consumptive activities, administrative practices as well as public visitation can all influence earth surface processes. An effective way to illustrate human influences on the processes is to go through some examples. This is not a comprehensive treatment and these examples do not occur in all parks.

Land uses (most commonly occurring adjacent to parks)

- Agriculture- intense use can cause loss of soil, erosion, and dust storms. Use of pesticides can affect both surface and groundwater quality.
- Grazing – overgrazing can cause loss of vegetation, conditions for invasive species, soil erosion and create conditions conducive to fires.
- Forestry – intensive logging or clear cutting creates conditions for increased erosion; sediment carried away can cause increased sediment loading in streams which could effect fluvial habitat.
- Water impoundment – This has the potential to affect one segment of a stream or river or the entire watershed. Controlled volume of flow does not duplicate natural events such as floods and drought. It can affect the sediment load, change the stream morphology and habitat that are dependent on a fluvial system.
- Urbanization – This can cause a host of influences, but a few stand out are; change in drainage patterns, increased erosion, affects on surface and groundwater, quality and quantity, release of toxins into the air, increased humidity in arid regions.
- Surface disturbances such as overgrazing, plowing or removing vegetation can influence the material available for transport.
- Dredging, beach mining, river modification, installation of protective structures removal of back-shore vegetation alterations of the near-shore can potentially alter shoreline processes, position and morphology by changing the sediment supply.

Consumptive Uses

- **Groundwater withdrawal – In instances where we deplete the groundwater resource to the point where it can not recharge itself, then we affect the groundwater-dependent ecosystem. Where withdrawal has been intense for a number of decades, the surface has been known to collapse (subside) over many acres to depths of over 10 feet.**
- **Oil and gas production – this can cause surface subsidence and contamination of water aquifers and cave & karst systems.**
- **Mining (open pit and underground) – It can reconfigure the landscape over large areas bringing significant and permanent change to the landscape. It can affect the groundwater by releasing heavy metals or other chemicals into the system. The ramifications of this type of mining are not fully understood.**

- **Mineral Materials Mining** – the quarrying of stone, mining of gravel and borrowing of soil, if done in large volume or smaller volume but in critical locations in the ecosystem, impacts geologic process by the sheer volume of material removed.

Administrative Use

- **Roads & bridges** – Often these have been constructed with little or no consideration for natural processes. Roads can disrupt drainage, cause erosion and create hillslope instability. The abutments for bridges can change the flow and morphology of streams and rivers.
- **Parking lots** – Their construction and location can cause harm. Large paved areas (acres) deprive the surface of an opportunity to absorb precipitation. Water flowing from the parking lots can cause erosion and gulying if not directed properly. Runoff pollution affects surface and groundwaters.
- **Facilities placed over caves** – Contaminants from restrooms and other water usage, plus runoff can reach the cave and karst system below causing damage to the fragile subterranean ecosystem.
- **Water consumption** – Parks located in arid environments need special consideration for all aspects of water usage (restrooms, watering lawns, domestic use for staff maintenance shops, etc.)
- **Trails** – If they are poorly located with respect to soil, rock and vegetation considerations, they have the potential to exacerbate erosion, rock falls and slope instability.
- **Armoring streams, rivers and coast** – Sometimes, in our zeal to keep nature in it's place by rock armoring, we change the fluvial and shoreline processes thereby affecting the ecosystem.
- **Planting exotic species** – Planting non-native species on sand dunes to hold them in place disrupts the aeolian process and can have changes on the ecosystem.

Visitor Use

- **Trampling, Compaction of Soil** – Over use by too many people in a small area can compact the soil and diminish its capability to function and maintain itself as a viable part of the ecosystem.
- **Social trails** – Depending on the fragile nature of the environment, wandering off-trail can serious damage fragile resources (such as in caves, wetlands, cryptobiotic crust, cinder cones, tundra, etc.)
- **Touching fragile features** – A number of geologic features have taken years to form through geologic processes, and although seemingly rock-hard, they can be rather fragile. Examples include stalactites and stalagmites in caves. Also included are erosional features, such as, arches, bridges, hoodoos, and badlands. Crystals are another example. Visitors touching or climbing on all these features can cause irreparable damage.

- **Power boating – Over a period of time, wakes from small and large boats alike can contribute to shoreline erosion. Fuel contamination can affect water quality.**

These examples are provided to stimulate the readers thinking, raise awareness and perhaps contemplate additional cases from one's own experience. The CRMO scoping meeting identified two human activities that highly influenced geologic processes in the park; 1) water diversion from the park's most important perennial stream and 2) destruction of cinder cone surfaces from social trails.